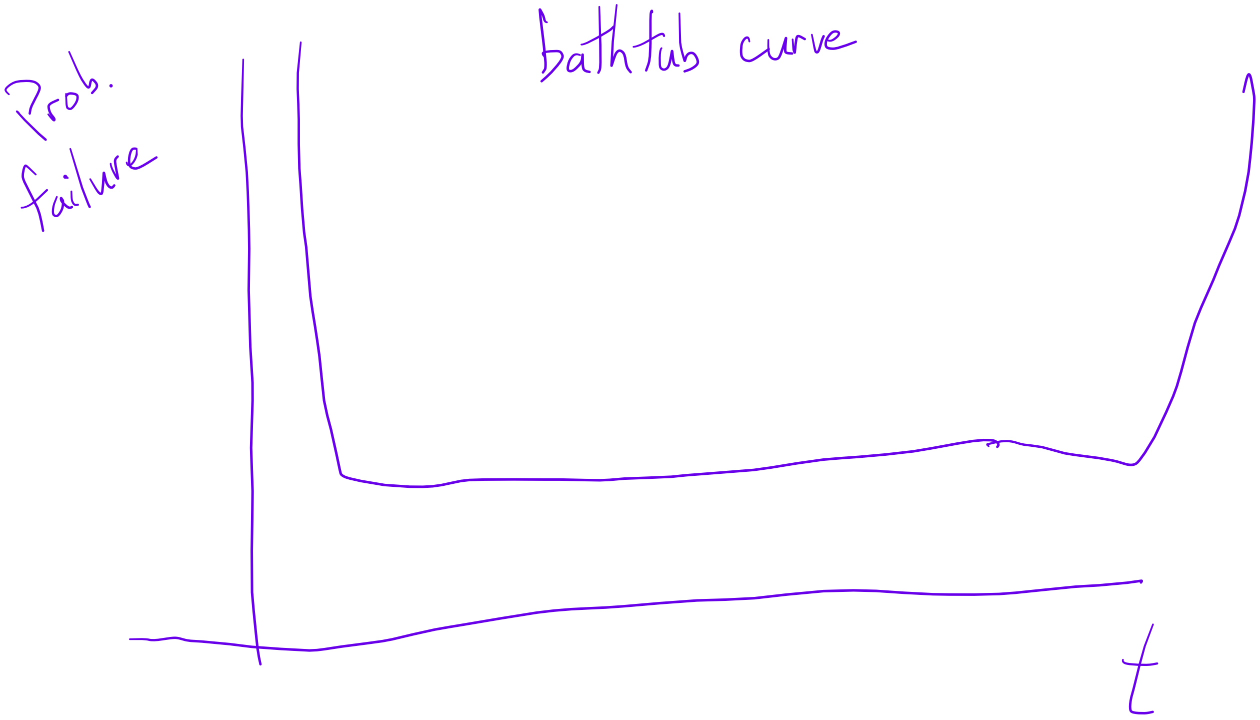
☑ 1. Last time

☑ 2. Intro to file systems

☑ 3. Files

☑ 4. Implementing files



2.

Intro to file systems

What does a FS do?

- provide persistence
- create a way to name data on the disk

FS: can be implemented in lots of places

- We focus on the disk, generalize later

Note: disk is the 1st thing we've seen that is <u>both</u> modifiable <u>and</u> persistent.

3.

Files

What is a file?

From user's view: a named, contiguous run of bytes

From FS's view: collection of disk blocks

Job of a FS:

map {file, offset in file} $\xrightarrow{FS}$ disk address operations:

create(file), delete(file), read(), write()

Goal: operations have as few disk accesses as possible and minimal space overhead

4. Implementing files

- ☑ A. Contiguous
- □ B. Linked files
- □ C. Indexed files

Assume for now that a given file's metadata is known to the system.

Access patterns to support:

- Sequential
- Random access

Ideal is good sequential + good random access performance

Candidate designs:

A. Contiguous allocation

user pre-specifies length

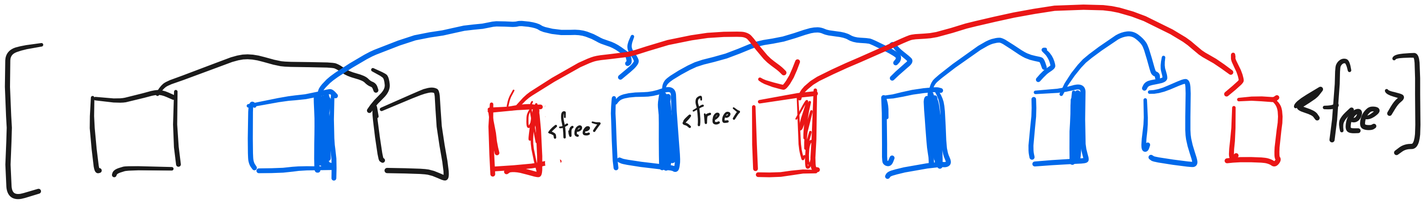
[<1 free> a1 a2 a3 <5 free> b1 b2 <1 free>]

+ fast access, both seq. and R.A.
+ simple

- fragmentation

B. Linked files

metadata is pointer (disk address) to file's first block



+ seq. access easy + probably fast

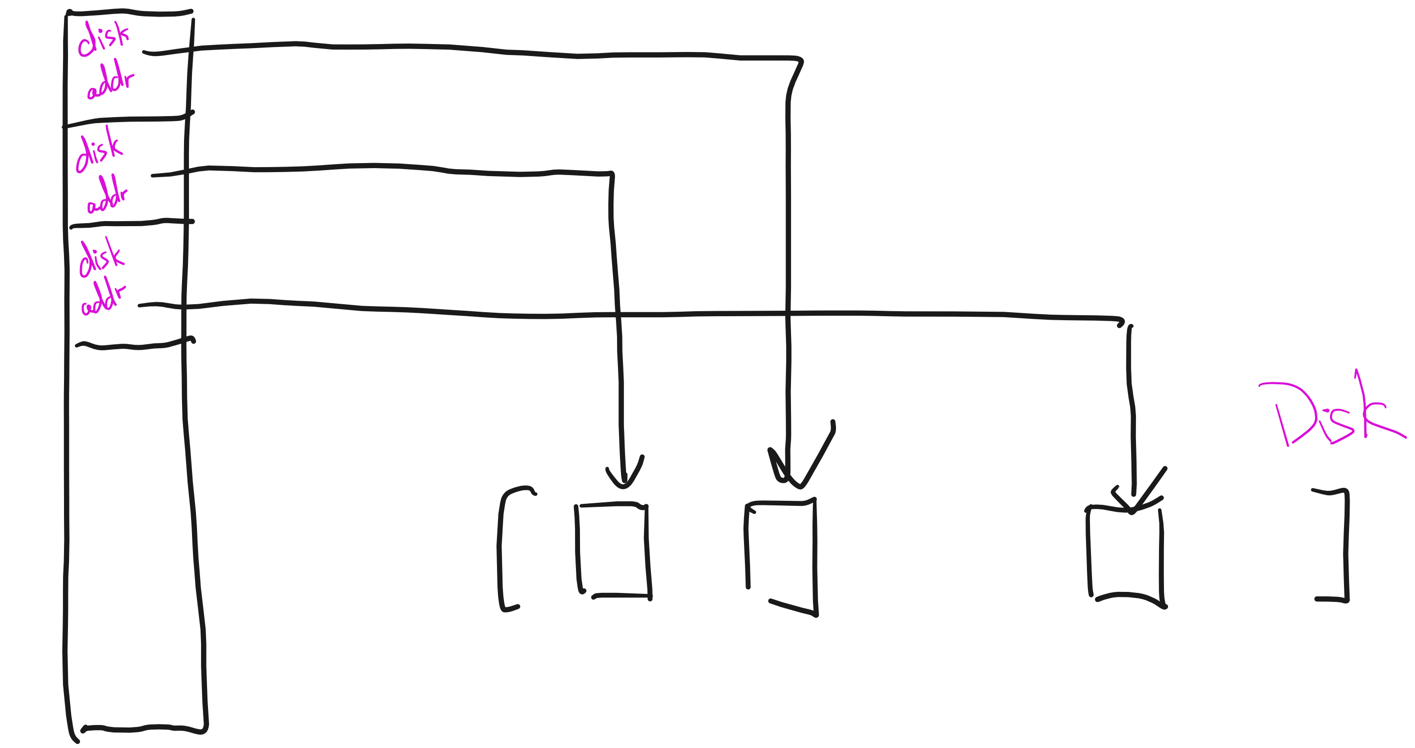
+ no more fragmentation

- R.A. is a disaster
- alignment of data can get messed up

C. Indexed files

attempt 1

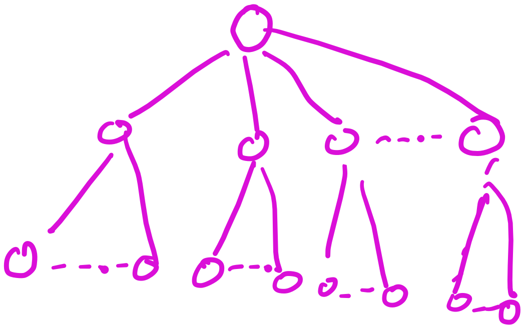
metadata: attemp



+ seq, R.A. easy

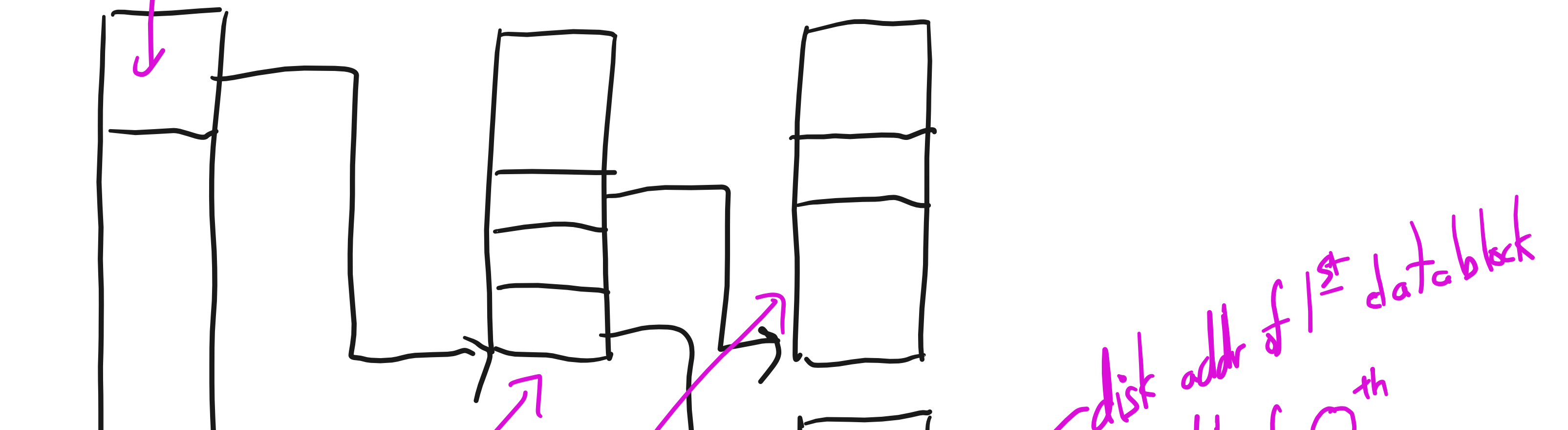
+

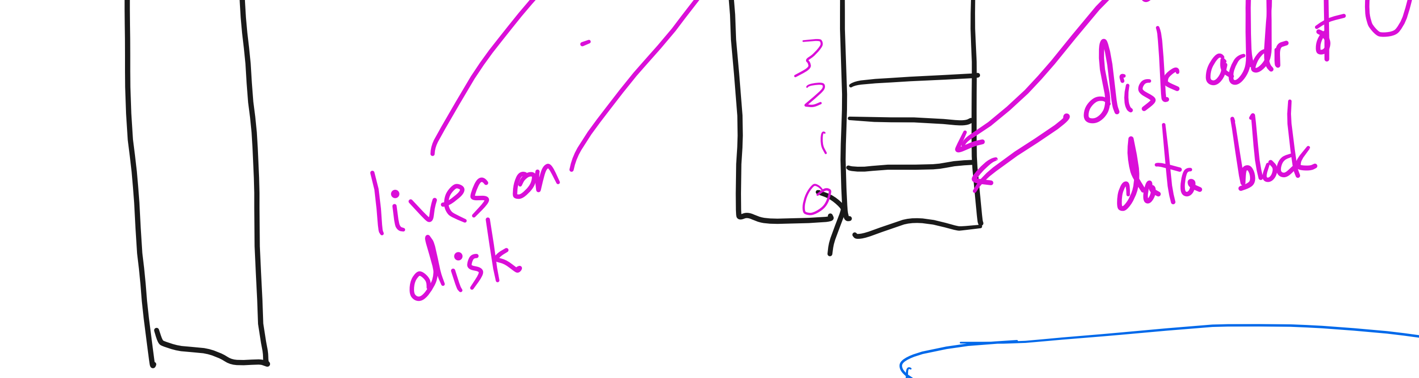
- storing this array is impractical



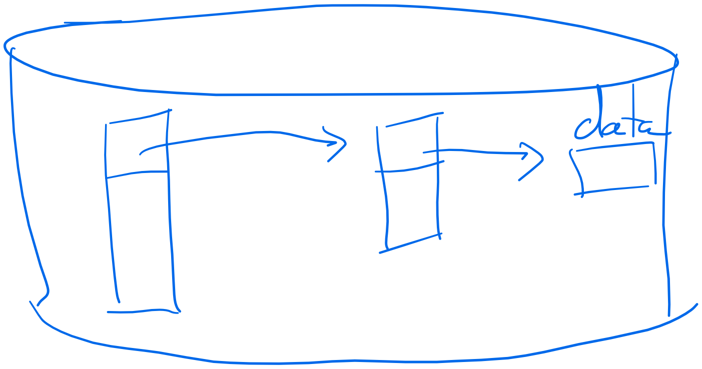
disk addr of metadata

attempt 2





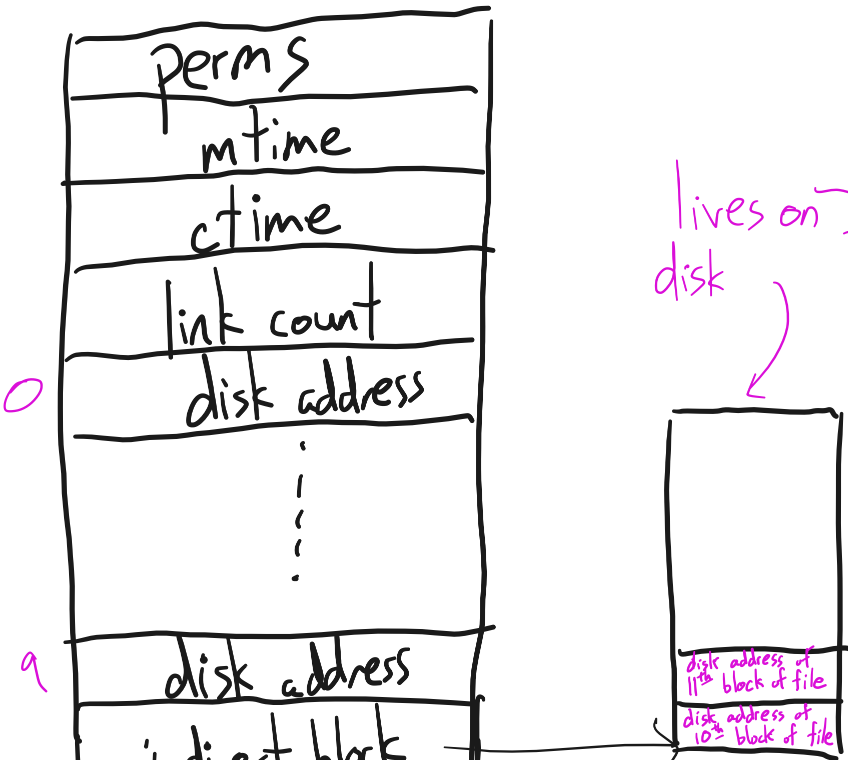
+ metadata is compact

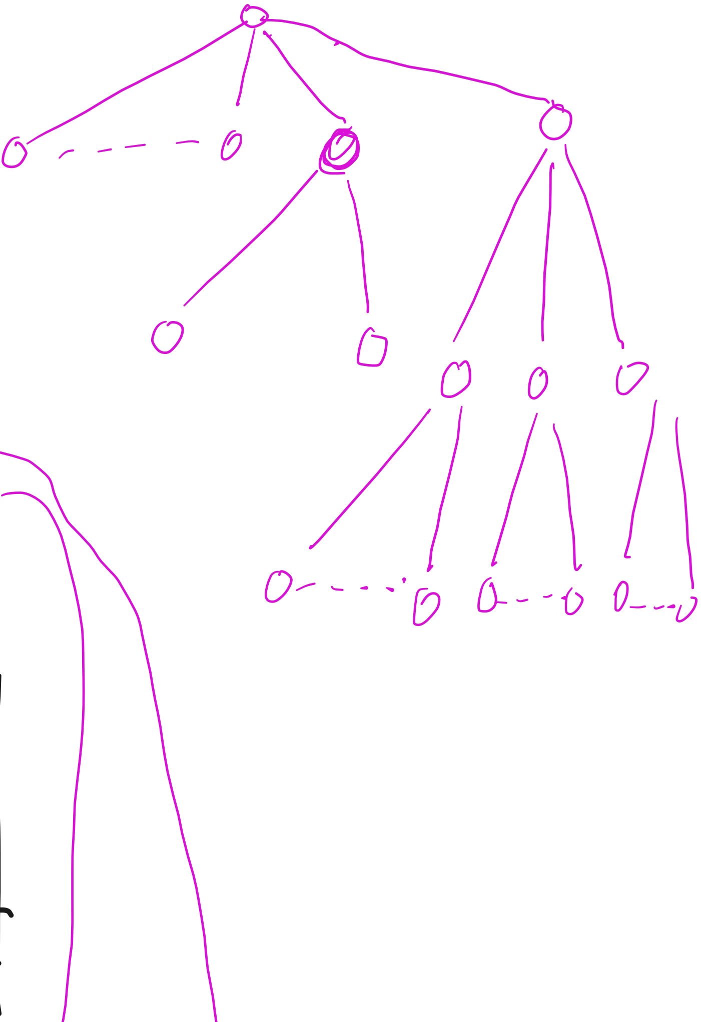


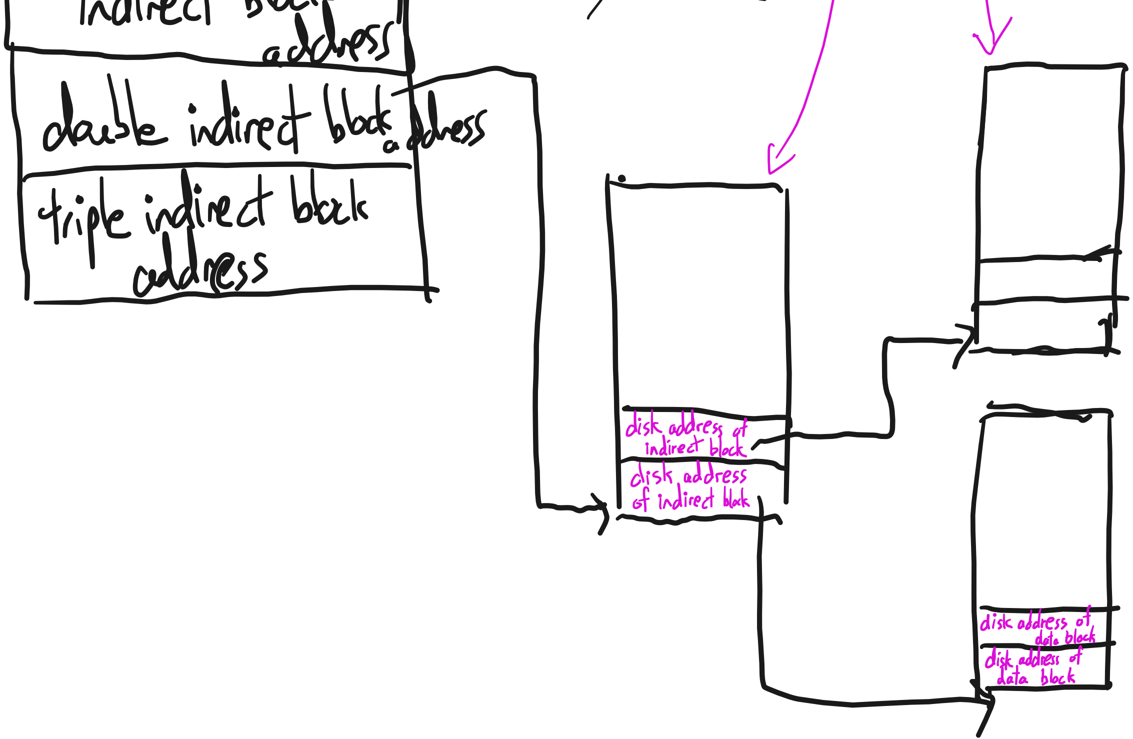
- looking up any block requires many disk accesses

attempt 3

Metadata: inode






indirect block address
double indirect block address
triple indirect block address
disk address of indirect block
disk address of indirect block
disk address of data block
disk address of data block

+ fast access to small files

+ Max length can be enormous

+ Simple, easy to build

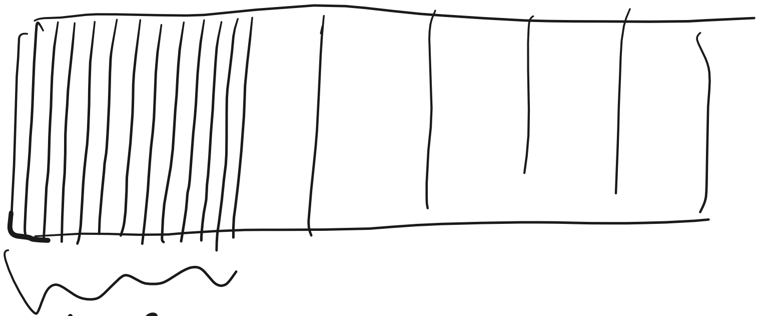
- worst case # of accesses: pretty bad

- " " space ovhd. " "

- locality issues

inodes: stored in a fixed-size array, known location

vocab: "inumber"



stat (&sb);

slots for
inodes

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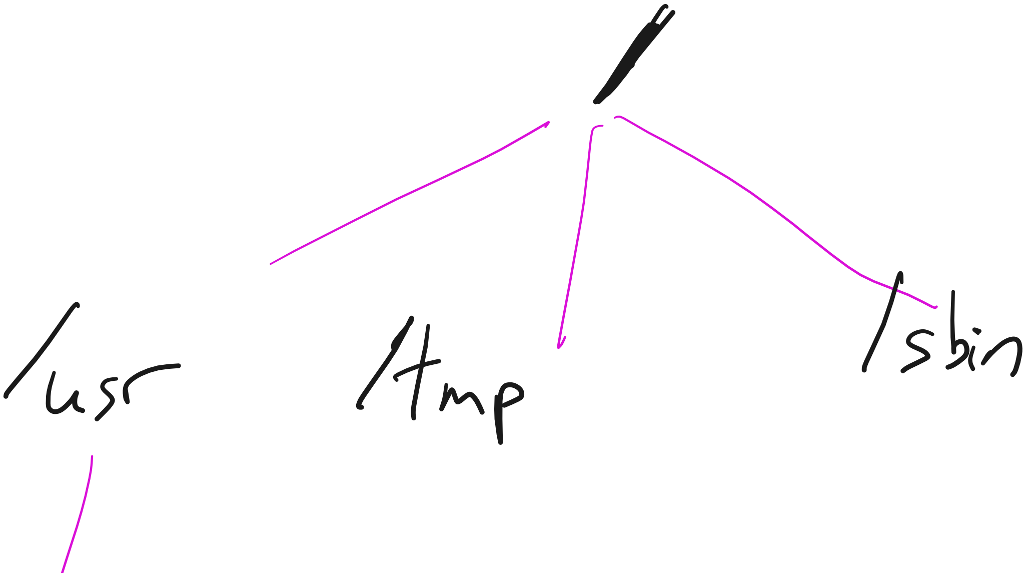
5. Directories (next time)

/bin/

/sbin

/usr

/tmp



/usr/mw

/lab4

kernel.c _ . .